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Standards for the Management of acute ST-segment Elevation Myocardial Infarction (STEMI) in Québec (April 2021 update)

Une production de l'Institut national d'excellence en santé et en services sociaux (INESSS)

Québec

Expert committee (in alphabetical order)

Dr. Jean-Pierre Déry, interventional cardiologist, Institut universitaire de cardiologie et de pneumologie de Québec

Dr. Yves Girard, internist, Centre hospitalier régional Baie-Comeau

Dr. Richard Harvey, interventional cardiologist, Centre hospitalier universitaire de Sherbrooke

Dr. Simon Kouz, cardiologist, Centre hospitalier régional de Lanaudière

Dr. Philippe L'Allier, interventional cardiologist, Institut de cardiologie de Montréal

Dr. Normand Racine, cardiologist, Réseau québécois de cardiologie tertiaire et Institut de cardiologie de Montréal

Dr. Stéphane Rinfret, interventional cardiologist, Centre universitaire de santé McGill

Dr. Dave Ross, general practitioner, Services préhospitaliers d'urgence en Montérégie, Université de Montréal et Hôpital du Sacré-Cœur de Montréal

Dr. Eli Segal, emergency physician, Hôpital général juif de Montréal et Corporation d'Urgences-santé

Dr. Alain Tanguay, general practitioner, Centre intégré de santé et de services sociaux Alphonse-Desjardins, Lévis

Comité national d'experts du continuum de services en infarctus aigu du myocarde avec élévation du segment ST (IAMEST)

Dr. Jean-Pierre Déry, Co-president, cardiologist, Institut universitaire de cardiologie et de pneumologie de Québec

Dr. Érick Schampaert, Co-president, cardiologist, Hôpital du Sacré-Cœur de Montréal

Ms. Elizabeth Arpin, Representative of the Direction des services hospitaliers of the Ministère de la Santé et des Services sociaux (MSSS) responsible for implementation of the STEMI service continuum, Special Advisor, Direction générale adjointe des services hospitaliers, du médicament et de la pertinence clinique

Dr. Élyse Berger, Assistant General Director, Direction générale adjointe des services préhospitaliers, des urgences et de l'accueil clinique of MSSS

Dr. Catherine Bonin, Clinical-administrative Representative, Assisant Director of Professionnel Services, primary and secondary centre settings, Centre intégré de santé et de services sociaux (CISSS) des Laurentides

Mr. Pierre Bouchard, Director of Services d'urgence, Direction générale adjointe des services préhospitaliers, des urgences et de l'accueil clinique of MSSS

Dr. Jean-Christophe Carvalho, Clinician Representative, cardiologist, Director of Professional Services, secondary centre setting, CISSS du Bas-Saint-Laurent

Mr. Sébastien Gaudreault, Clinician Representative, Regional Coordinator of Services préhospitaliers d'urgence, Centre intégré universitaire de santé et de services sociaux (CIUSSS) de la Capitale-Nationale

Dr. Pierre Guérette, National Director of Services d'urgence, Direction générale adjointe des services préhospitaliers, des urgences et de l'accueil clinique of MSSS

Ms. Denise Hébert, Clinical-Administrative Representative, Manager responsible for the Unité de coordination clinique des services préhospitaliers d'urgence, secondary centre setting, CISSS de Chaudière-Appalaches

Mr. Eduardo Hernandez Hurtado, Manager of the IM-Québec databank

Ms. Marie-Hélène Jean, Clinical-Administrative Representative, Head Nurse of Hemodynamics, tertiary centre setting, Institut universitaire de cardiologie et de pneumologie de Québec

Dr. Simon Kouz, Clinicien Representative, cardiologist, secondary centre setting, CISSS de Lanaudière

Ms. Nathalie Labrecque, Interim Representative of the Direction des services hospitaliers of MSSS

Dr. Philippe Lavoie-L'Allier, Clinician Representative, cardiologist, tertiary-quaternary centre setting, Institut de cardiologie de Montréal

Ms. Chantal Lehoux, Clinical-Administrative Representative, regional cardiology respondent, CIUSSS de la Mauricie-et-du-Centre-du-Québec

Ms. Nathalie Mercier, Representative of the Direction des services hospitaliers du MSSS responsible for implementation of the STEMI service continuum, Coordinator of tertiary cardiology

Dr. Lucie Poitras, Assistant General Director of Services hospitaliers, du médicament et de la pertinence clinique of MSSS

Dr. Joël Pouliot, Clinicien Representative, cardiologist, internist, primary centre setting, CISSS de l'Abitibi-Témiscamingue

Dr. Normand Racine, cardiologist, President of the Réseau québécois de cardiologie tertiaire

Dr. Stéphane Rinfret, Clinician Representative, cardiologist, Chief of Hemodynamics, tertiary-quaternary centre setting, McGill University Health Centre

Dr. Dave Ross, Clinician Representative, Regional Medical Director, Services préhospitaliers d'urgence, Montérégie

Ms. Amélie Roy, Assistant to the director of the Réseau universitaire de santé de l'Université de Montréal

Dr. Alain Tanguay, Clincian Representative, Founder of the Unité de Coordination clinique des services préhospitaliers d'urgence, CISSS de Chaudière-Appalaches

External reviewers

Dr. Michel Le May, interventional cardiologist, Director of the University of Ottawa Heart Institute Regional STEMI Program, Professor of Medicine and Researcher

Dr. Daniel Lefrançois, Director of Professional Services, Institut universitaire de cardiologie et de pneumologie de Québec, Assistant Director of Professional Services at the CISSS de Chaudière-Appalaches

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Responsibility

INESSS takes full responsibility for the final form and content of this document.

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SUMMARY

Acute myocardial infarction with ST-segment elevation (STEMI) is a serious and frequent event that must be urgently treated with either percutaneous coronary intervention (PCI) or fibrinolysis. To improve the management of STEMI, the *Institut national d'excellence en santé et en services sociaux* (INESSS) published, in 2016, a field evaluation (for 2013-2014) [INESSS, 2016a] and an evidence review on optimal modalities [INESSS, 2016b], which were used to develop standards of care for Québec [INESSS, 2016c]. New Canadian clinical practice guidelines [Wong *et al.,* 2019] and an update of directives by the *Collège des médecins du Québec* (CMQ) on interhospital transfer [2020] confirmed the need to update the standards published in 2016.

The standards herein are based on a review of the scientific literature published from January 2016 to November 2019, with a further literature update in January 2021, and on the consensus of an expert advisory committee. The central theme of this project is organizational: the standards do not address purely clinical or technical aspects of treatment nor the pediatric context. They focus on the structures and processes associated with effective and timely STEMI management in the pre-, intra- and inter-hospital phases, from first medical contact to the decision on interhospital transfer following reperfusion treatment. This update has been validated by a second group of experts recently established by the *Ministère de la Santé et des Services sociaux*, the *Comité national d'experts du continuum de services en IAMEST*, as well as by two external reviewers.

The updated standards are presented according to five areas: ambulance services; hospitals that do not offer PCI; hospitals that offer PCI; networks – communication, structure and integration of services; and support of quality improvement. There are now 40 standards in total: 17 new standards have been added, 14 have been revised, and 9 are unchanged. The changes notably address the maximum recommended time for direct ambulance transport of a patient in stable condition to a PCI hospital without medical escort, interhospital transfers, and the management of patients in cardiogenic shock. Some standards include quality indicators or targets for the purposes of performance evaluation and quality improvement.

The continuum of STEMI care is organized in networks, in which each hospital offering PCI is in partnership with one or more non-PCI hospitals and one or more ambulance services. The standards refer to this structure, and many of the processes of care are the shared responsibility of the services within each network. There is much diversity among Québec networks, particularly in terms of geographic location, size of territory covered, and population served. Recognizing this diversity, INESSS has not defined the specific protocol content for standards requiring application of protocols; instead, this content is to be adapted to the local reality.

ABBREVIATIONS AND ACRONYMS

ACCA-ESC	Acute Cardiovascular Care Association – European Society of Cardiology
ACTION-GWTG	Acute Coronary Treatment and Intervention Outcomes Network Registry – Get With the Guidelines (USA)
AGREE II	Appraisal of Guidelines for Research and Evaluation II
AHA	American Heart Association
CASP	Critical Appraisal Skills Programme
CCN	Cardiac Care Network (Ontario)
CCS	Canadian Cardiovascular Society
CISSS	*Centre intégré de santé et de services sociaux*
CIUSSS	*Centre intégré universitaire de santé et de services sociaux*
CMQ	*Collège des médecins du Québec*
ECG	Electrocardiogram
EMS	Emergency medical services
ESC	European Society of Cardiology
GGWGMSS	German Guideline Working Group of Medical Scientific Societies
INESSS	*Institut national d'excellence en santé et en services sociaux (Québec)*
MED-ÉCHO	*Banque ministérielle de maintenance et exploitation des données pour l'étude de la clientèle hospitalière (Québec)*
MSSS	*Ministère de la Santé et des Services sociaux (Québec)*
NASEMSO	National Association of State EMS Officials
NICE	National Institute for Health and Care Excellence (United Kingdom)
NICOR	National Institute for Cardiovascular Outcomes Research
PCI	Percutaneous coronary intervention
PPCI	Primary percutaneous coronary intervention
R-AMSTAR	Revision of assessing methodological quality of systematic reviews
STEMI	ST-segment elevation myocardial infarction
UCCSPU	*Unité de coordination clinique des services préhospitaliers d'urgence*

INTRODUCTION

Background

ST-segment elevation myocardial infarction (STEMI) is an acute condition whose immediate cause is occlusion of a coronary artery by a clot. It is a serious and common condition that must be treated with great urgency either by primary percutaneous coronary intervention (PPCI[1]) or by fibrinolysis. It is estimated that about 4,300 patients are hospitalized with STEMI in Québec each year [INESSS, 2016a].

Since time is the critical factor for improving the vital prognosis of the STEMI patient, an international consensus confirmed by numerous clinical practice guidelines [NICE, 2020; Wong *et al.,* 2019; Ibanez *et al.,* 2018; O'Gara *et al.,* 2013; Steg *et al.,* 2012; Welsh *et al.,* 2009; Antman *et al.,* 2004], stipulates that treatment of STEMI be initiated within narrow and well-defined time windows in order to reduce mortality and morbidity. Data from Québec have shown that reperfusion treatment delivered outside of the maximal recommended delay is associated with statistically significant increases in mortality at 30 days and in mortality and readmission for acute myocardial infarction or heart failure at 1 year [Lambert *et al.,* 2010].

In order to improve STEMI management, INESSS published, in 2016, a province-wide evaluation in the 'real-world' care context (for 2013-2014) [INESSS, 2016a] and an evidence review [INESSS, 2016b], which were used to develop quality standards for Québec [INESSS, 2016c]. Following publication of the standards, a tool kit and a guide were produced for health professionals and managers in the care network, as well as a standardized provincial prescription for fibrinolysis, to support treatment selection and facilitate performance evaluation of STEMI management [INESSS, 2017a; INESSS, 2017b; INESSS, 2017c].

Since 2017, INESSS has monitored the scientific literature on management of STEMI and was involved in updating the Canadian acute care practice guidelines. A preliminary analysis of these practice guidelines [Wong *et al.*, 2019] revealed several changes or new elements with respect to the 2016 Québec standards, regarding in particular:

- maximal transport duration for transporting a patient to hospital by ambulance;
- transmission of prehospital electrocardiogram (ECG) results for interpretation;
- recommended delay between first medical contact and initiation of treatment by PPCI for more isolated regions;
- management of STEMI patients in cardiogenic shock;
- transfer to a PCI centre following fibrinolysis treatment;
- medical escort (no longer automatically required) for interhospital transfer;

[1] PCI can also be carried out after fibrinolysis. In this case, the intervention is not considered "primary".

- new quality of care indicators regarding delays in the prehospital setting and in the catheterization laboratory.

More recently, the *Collège des médecins du Québec* [CMQ, 2020] released an update of its directives on interhospital transfers, clarifying certain aspects that were not addressed by the 2016 standards by INESSS. It was therefore deemed necessary to thoroughly review these two sources of recommendations and other relevant material in the literature in order to update the 2016 standards of care.

Objective

The objective of this document is to describe the methodology and the results of updating the recommended quality standards for the acute management of STEMI in Québec. The update is based on rigorous review of the literature and consensus work with an expert committee. The standards do not address purely clinical or technical aspects of treatment nor the pediatric setting.

The present document is relevant for:

- health care professionals in prehospital teams and emergency departments who receive STEMI patients, including ambulance personnel, emergency physicians, interventional and non-interventional cardiologists and internists;
- managers and decision-makers who are closely or more distantly involved in the management of STEMI patients during the acute phase of care.

The central theme of this project is organizational. It addresses structures and processes associated with effective and timely management of patients with STEMI in the pre-, intra- and inter-hospital phases of care, from first medical contact until decision-making about interhospital transfer following reperfusion treatment.

1. METHODOLOGY

The methodology used to update the standards complies with the production norms for systematic reviews and INESSS standards. A plan was developed beforehand and validated by INESSS's Direction de l'évaluation et de la pertinence des modes d'intervention en santé. This plan essentially proposed to re-examine the 2016 standards one by one in light of new recommendations and available evidence, as well as to assess the need for additional standards and to have the proposed revisions validated by an expert committee.

1.1. Retrieval of information

A targeted search of the scientific and grey literature related to organizational aspects of STEMI management (published from January 2016 to November 2019) was conducted in bibliographic databases and on the websites of relevant learned societies and scientific organizations. This search was rerun in January 2021 during the document's finalization stage to update the cited literature where necessary. The information search strategy was developed in collaboration with a scientific information specialist (librarian). The bibliographies of the retained documents were also consulted.

The search strategy was based on the following question: What new evidence requires the addition of a new standard or a modification to an existing standard with respect to:

- optimization of the organization of care and services (e.g., regionalization, networks) or organizational elements associated with good outcomes - e.g., coordinators, on-site cardiac surgery, procedure volumes?
- prehospital care processes - e.g., use of ECGs to guide the choice of receiving centre, maximum duration of transport considering the patient's clinical condition and the level of expertise of the care providers?
- STEMI quality of care indicators and their targets, including those in the prehospital phase?
- optimal strategies for care following fibrinolysis reperfusion therapy in a centre without a catheterization laboratory?
- optimal strategies for managing STEMI patients in cardiogenic shock?

The search for scientific information was conducted in several bibliographic databases: PubMed, Embase, EBM Reviews and Cochrane. Key organizations identified during the 2016 standards production process were consulted again to obtain any updates to the requirements from the scientific literature. The targeted literature included guidelines or other expert consensus documents from Canada, the United States, Europe, and Australia, as well as systematic reviews and meta-analyses. The search for information included guidelines from the *Collège des médecins du Québec*, relevant recent observational studies, and US national data from the Acute Coronary Treatment and

Intervention Outcomes Network Registry - Get With the Guidelines (ACTION-GWTG). Details of the different strategies are presented in Appendix A in the supplementary appendices document (available in French).

1.2. Selection, evaluation and extraction of information

The selection of documents identified by the information search was conducted independently by two reviewers according to the study selection criteria presented earlier. Differences of opinion were resolved by considering the opinion of a third reviewer. Details of the selection are presented in Appendix B in the supplementary appendices document.

The quality assessment of the scientific studies was performed by one reviewer, using the Revision of assessing methodological quality of systematic reviews (R-AMSTAR) tool [Shea *et al.,* 2017] for systematic reviews, the Appraisal of Guidelines for Research and Evaluation (AGREE II) tool [Brouwers *et al.,* 2016] for guidelines, and the Critical Appraisal Skills Programme (CASP) list for observational cohort or case-control studies [CASP, 2018]. The assessments were validated by a second reviewer. Study characteristics and quality scores are presented in Appendix C in the supplementary appendices document.

Data extraction was performed by one reviewer using NVivo software and previously developed extraction forms which had been tested on a few studies to ensure their validity. Data were validated by a second reviewer. The extraction grids are presented in Appendix D in the supplementary appendices document.

1.3. Consultation with an expert committee

This document was developed in collaboration with an advisory committee composed of experts in cardiology, internal medicine, emergency medicine (which includes the prehospital domain), and prehospital and hospital management. The expert advisory committee includes the same members who participated in the development of the provincial standards in 2016, with the addition of an internist from a remote region and a general practitioner-researcher from the *Unité de coordination clinique des soins préhospitaliers d'urgence* (UCCSPU).

The elements extracted from the literature were used by the project team to revise the wording of existing standards or to formulate new standards. A modified Delphi method[2] was used with the expert committee to reach consensus on these proposals. Two rounds of consultation were conducted via email. Agreement, disagreement and comments were collected and processed by the project team. The minimal target for consensus was set at 75%. Feedback and reworded text were provided anonymously to committee members at each round of consultation. Subsequently, a videoconference meeting with committee members was held to finalize the standards that had generated the most comments.

[2] According to this approach, a meeting by videoconference is added at the end of the remote consultation cycles. This element was not part of the original Delphi method [Eubank *et al.*, 2016].

1.4. Validation by stakeholders and peers

The standards were sent to a second group of experts recently established by the MSSS, called the *Comité national d'experts du continuum de services en IAMEST*, for their feedback, particularly with respect to the applicability of the standards in the real-world context of care in Québec. The standards were also sent to two external scientific reviewers. Comments from the provincial committee members and the external reviewers were analyzed by the project team and incorporated into the final document where deemed necessary.

1.5. Implementation and evaluation

The revised standards detailed in the following section will be the subject of a dissemination plan to stakeholders, including prehospital authorities, managers and heads of hospital departments, associations, federations, professional orders and the MSSS. As before, INESSS will provide a toolkit to support the implementation of the standards and the use of quality indicators, some of which are already being implemented. The standards will guide future quality of care evaluation cycles by INESSS, as appropriate. Finally, the Institute will maintain a watch on the scientific literature in order to proceed with future updates as required.

2. STANDARDS

2.1 General considerations

The primary objective of the standards is to support the timely and effective management of adult patients suspected to have acute ST-segment elevation myocardial infarction (STEMI). The standards were developed based on the following general principles:

- provide the best possible quality of care for people with STEMI;
- ensure timely reperfusion therapy;
- ensure access to care and services 7 days a week, 24 hours a day.

In addition to the principles outlined above, the STEMI standards of care take the following elements into account [INESSS, 2017a; INESSS, 2016a; INESSS, 2016b; INESSS 2016c; Lambert *et al.,* 2014; Lambert *et al.,* 2010]:

- the effectiveness of reperfusion therapy in patients with STEMI is time-dependent;
- access to PPCI varies according to the geographic distribution of facilities with catheterization laboratories;
- the continuum of cardiac care in Québec involves more than 80 acute care hospitals. There are 15 PCI centres with catheterization laboratories. The majority (9) of these centres are located in the urban regions of Montréal, Laval and Quebec City as well as in Montérégie (2), and in each of the following regions: Outaouais (1), Estrie (1), Mauricie et Centre-du-Québec (1) and Saguenay–Lac-Saint-Jean (1);
- the continuum of cardiac care is organized in networks where each hospital that offers PCI ("PCI hospital") is partnered with one or more hospitals that do not offer PCI ("non-PCI hospitals") and one or more (prehospital) emergency medical services. The standards refer to this structure, and many of the processes of care are the shared responsibility of the services within each network. There is much diversity among Québec networks, particularly in terms of geographic location, size of territory covered, and population served. Recognizing this diversity, INESSS has not defined the specific protocol content for standards requiring the application of protocols; instead, this content is to be adapted to the local reality;
- emergency medical services in Québec are mostly provided by primary care paramedics ('basic life support' emergency medical technicians), based on computerized interpretation of prehospital ECGs and the regional protocols in effect;
- incorrect computerized interpretation of the prehospital ECG can lead to unnecessary activation of the catheterization laboratory, and thus futile use of human and material resources;

- patients transferred to receive PPCI are less likely to be treated within the recommended time frame than patients treated with fibrinolysis or PPCI after direct admission to a PCI hospital;
- the indicator performance targets for standards in this document are aligned with those of the Canadian Cardiovascular Society [Wong *et al.*, 2019] and the American Heart Association [Mission: Lifeline, 2013], which use a 75% target for several of their indicators;
- as much as possible, each quality standard has been designed to be operational and potentially measurable; an effort has been made to limit the number of quality indicators in the interest of feasibility.

2.2 Explanatory notes

In the following section, the literature sources that support a standard, in whole or in part, are indicated in italics, as are the strength of the recommendation and the assigned level of evidence when provided by practice guidelines (see the definition of the grading and classes of recommendations in Appendix E in the supplementary appendices document). When a standard is based solely on the opinion of the expert committee members (in the absence of a literature source), this is indicated in italics. For the purposes of performance evaluation and quality improvement, the targets for the retained quality indicators are indicated in blue.

It should be noted that "first medical contact" refers to arrival of ambulance personnel at the patient's side for users of emergency medical services (this time is documented on the intervention form by the paramedic), or to the time of triage for patients who arrive at a hospital by other means (this time is documented at triage). The "first intervention with intention to treat with PPCI" refers to the moment when the first device is used with intention to reperfuse after insertion of the guiding catheter in the infarct-related artery [CCS, 2015].

For each standard, it is indicated whether it has been revised (R), unchanged (not modified, NM), or is new (N) with respect to the 2016 document. Table 1 summarizes the changes and additions to the standards[3].

[3] Unchanged standards are not included in this table.

Table 1 Summary of the number of revised and new standards

Section of document	Domain of the literature search (subjects addressed, standard #)				
	Organization of care and services	**Prehospital care**	**Quality indicators and their targets**	**Strategies following fibrinolysis**	**Cardiogenic shock**
Emergency medical services	no change	5 revised (transmission, protocols, transport without medical escort, #1-3, 8, 9)	no change	no change	no change
	no change	2 new (supplemental ECGs, use of stretcher and vehicle, #6, 10)	3 new (transmission, delay before ECG, alerting hospital, #4-5, 7)	no change	no change
Non PCI hospitals	1 revised (prescription, #12)	no change	no change	no change	1 revised (referral options, #21)
	6 new (interhospital transport without medical accompaniment, transfers, #14-19)	no change	no change	no change	no change
PCI hospitals	1 revised (lengthening of delay from contact to PPCI, #29)	no change	1 revised (preparation of catheterization laboratory, #24)	no change	no change
	2 new (access to coronary unit, documentation, #25, 30)	no change	1 new (delay before arrival in catheterization laboratory for PPCI, #28)	no change	no change
Networks	2 revised (agreements, documentation, #32, 35)	no change	no change	no change	no change
	1 new (transfers to non-PCI hospital of origin, #36)	no change	1 new (performance of a non-PCI hospital according to default strategy, #33)	1 new (protocols, #34)	no change
Support for quality improvement	no change	no change	3 revised (monitoring frequency, networks and indicators, #38-40)	no change	no change

2.3 Emergency medical services (EMS)

R 1. All ambulance personnel have access to equipment for 12-lead ECG acquisition at the patient's side, transmission of ECG results by telemetry and cardiac defibrillation.

Note: The principal objective of transmission of ECG results by telemetry is to reduce the number of false positives (cases incorrectly identified as STEMI).

Sources: for acquisition of ECGs: Wong et al., 2019 (CCS) [strong, level of evidence low]; Beygui et al., 2020 (ACCA-ESC); O'Connor et al., 2015 (AHA) [class I, level of evidence B]; O'Gara et al., 2013 (AHA) [class I, level of evidence B]; CCN, 2013a; for transmission: Beygui et al., 2020 (ACCA-ESC); NASEMSO, 2019; Bussières et al., 2018 (feasibility); for harmful effect of computerized ECG interpretation: O'Connor et al., 2015 (AHA) [class III (harm), level of evidence B]; De Champlain et al., 2014; for defibrillation: Ibanez et al., 2018 (ESC) [class I; level of evidence C].

R 2. All ambulance personnel receive standardized continuing education on 12-lead ECG acquisition, cardiac defibrillation, clinical evaluation and transmission of ECG results by telemetry.

Sources: for acquisition of ECGs: Wong et al., 2019 (CCS); O'Connor et al., 2015 (AHA) [class I, level of evidence B]; O'Gara et al., 2013 (AHA) [class I, level of evidence B]; CCN, 2013a; Mission: Lifeline, 2013; Rokos et al., 2013 (Mission: Lifeline); for defibrillation: Ibanez et al., 2018 (ESC) [class I; level of evidence C].

R 3. All ambulance personnel use protocols[4] that specify for which patients ECGs are to be acquired, how to communicate results and the processes to be followed according to the ECG results and evaluation of the patient.

Sources: Wong et al., 2019 (CCS); Nam et al., 2014; CCN, 2013a.

N 4. Given the limitations of computerized interpretation, and in the absence of on-scene interpretation by a trained care provider, the transmission of ECG results by telemetry by ambulance personnel for interpretation by a physician or other expert is favoured (e.g. to a designated PCI centre or a regional STEMI care coordination centre).

TARGET: In a network where transmission of ECG results by telemetry is used, transmission by telemetry is carried out by emergency medical services for at least 75% of patients for whom computerized interpretation indicates STEMI.

Sources: Wong et al., 2019 (CCS); Beygui et al., 2020 (ACCA-ESC); NASEMSO, 2019; Bussières et al., 2018 (feasibility); for harmful effect of computerized ECG interpretation: O'Connor et al., 2015 (AHA) [class III (harm), level of evidence B]; De Champlain et al., 2014.

N 5. The maximum delay between first medical contact and acquisition of the prehospital ECG is 10 minutes.

TARGET: The first prehospital ECG is acquired by emergency medical services within a maximum of 10 minutes after arrival at the patient's side for at least 75% of patients for whom it is clinically indicated.

Sources: Wong et al., 2019 (CCS) [strong; level of evidence low]; Ibanez et al., 2018 (ESC) [class I; level of evidence B]; Beygui et al., 2020 (ACCA-ESC); NASEMSO, 2019; Scholz et al., 2018.

[4] The term protocol refers to a *written* document.

N

6. If there is a choice of destination (i.e., PCI or non-PCI hospital), pre-established prehospital protocols are used that require supplementary ECGs to be acquired when the two first prehospital ECGs (the initial ECG and the ECG acquired prior to departure for hospital) do not show signs of STEMI, but chest pain persists or there is a change in the clinical condition of the patient.

Sources: NASEMSO, 2019; Tanguay et al., 2018.

N

7. The communication processes between emergency medical services and the receiving hospitals or regional STEMI care coordination centre are established for each care network, such that hospitals are notified as soon as possible of the pending arrival of a patient with suspected STEMI.

TARGET: Receiving hospitals are notified of an arrival in advance by emergency medical services for at least 75% of patients for whom STEMI is identified in the prehospital setting.

Sources: Wong et al., 2019 (CCS) [strong; level of evidence low]; NASEMSO, 2019; AHA, 2018; Shavadia et al., 2018; Scholz et al., 2018; Bussières et al., 2018; CCN, 2013a.

R

8. Prehospital protocols that formally designate destination hospitals are used for patients with suspected STEMI, according to the patient's geographic location and specific clinical needs, and consistent with other relevant standards (e.g., recommended maximal delays).

Sources: Wong et al., 2019 (CCS); AHA, 2018; Green et al., 2018; CCN, 2013a.

R

9. a) Destination protocols promote and support direct ambulance transport to the designated PCI hospital for patients with suspected STEMI, consistent with other relevant standards (e.g., recommended maximal delays).

b) These protocols favour initial transport by ambulance to a PCI hospital when the transport duration is a maximum of 60 minutes, as long as the suspected STEMI patient is clinically stable.

c) Pre-established protocols are used if the patient's clinical condition deteriorates, consistent with the directives of the *Collège des médecins du Québec* [CMQ, 2020].

Sources: for direct transport to a PCI hospital: Wong et al., 2019 (CCS) [strong, level of evidence low]; Beygui et al., 2020 (ACCA-ESC); Alrawashdeh et al., 2020; O'Connor et al., 2015 (AHA); O'Gara et al., 2013 (AHA) [class I, level of evidence B]; for the duration of transport and personnel: Wong et al., 2019 (CCS); Bussières et al., 2018; Froats et al., 2018; Mitchell et al., 2018; Kwong et al., 2018.

N

10. Upon arrival of an ambulance at the emergency department of a non-PCI hospital, and in the event that STEMI is clinically indicated and an in-hospital ECG is deemed necessary, the ECG is performed within 10 minutes of arrival while the patient remains on the ambulance stretcher. If an interhospital transfer is deemed necessary following the ECG, the patient is transported without delay by the same ambulance[5] to the designated PCI hospital[6].

Note: The systematic repetition of ECG acquisition (in the case of a positive prehospital ECG) is not recommended. Evaluation in the real-world care context carried out by INESSS [2016a] showed that, for patients who already had a prehospital ECG that was positive for STEMI, the acquisition of another ECG in hospital was associated with an increased delay before reperfusion treatment.

Source: Ibanez et al., 2018 (ESC); for the maximal delay: Wong et al., 2019 (CCS) [strong, level of evidence low].

2.4 Hospitals that do not offer percutaneous coronary intervention (PCI) (non-PCI hospitals)

The following section presents the standards for hospitals that do not offer PCI. Some patients who present with symptoms of STEMI arrive at non-PCI hospitals by means other than ambulance transport or are transported there by emergency medical services for various reasons. These hospitals play an essential role in diagnosing STEMI, deciding whether to carry out interhospital transfer to access PPCI, administering fibrinolysis or deciding to not perform reperfusion treatment, if appropriate.

NM

11. If an ECG is deemed necessary at a non-PCI hospital, it is acquired, and the results interpreted by a physician, within a maximum of 10 minutes after triage of the patient.

TARGET: The first in-hospital ECG is acquired at a non-PCI hospital within a maximum of 10 minutes after triage for at least 75% of patients for whom it is clinically indicated.

Sources: Wong et al., 2019 (CCS) [for the standard: strong; level of evidence low]; CCN, 2013a; Mission: Lifeline, 2014 and 2013; AETMIS, 2008, citing AHA's practice guidelines by Antman et al., 2004 [class I, level of evidence C].

R

12. If a patient does not present contraindications to fibrinolysis at a non-PCI hospital AND the delay between first medical contact and first intervention with intention to treat with PPCI will exceed 120 minutes, the administration of fibrinolysis is favoured, in accordance with the provincial prescription published by INESSS.

Sources: Wong et al., 2019 (CCS) [strong; level of evidence high]; INESSS, 2017c; O'Connor et al., 2015 (AHA); O'Gara et al., 2013 (AHA) [class I, level of evidence B]; CCN, 2013a.

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[5] Based on the experience of members of the *Comité national d'experts du continuum de services en IAMEST*, it is important to dispatch a new vehicle rapidly if it is not possible to use the same ambulance for transfer (especially in regions covering large geographic areas).

[6] Based on the experience of members of the *Comité national d'experts du continuum de services en IAMEST,* initiation of fibrinolysis treatment (if indicated) and its continuation during transfer to a PCI centre, with medical escort, is a strategy that reduces delay.

NM

13. In the presence of contraindications to fibrinolysis when presenting at a non-PCI hospital, the patient is transferred as rapidly as possible to a PCI hospital.

Source: O'Gara et al., 2013 (AHA) [class I, level of evidence B].

N

14. a) If interhospital transfer from a non-PCI hospital to a PCI hospital is deemed necessary, basic life support ambulance personnel are authorized to transport the patient for up to 60 minutes[7], without additional accompanying medical personnel, if the patient with suspected or confirmed STEMI is judged to be clinically stable[8].

b) Pre-established protocols are used if the patient's clinical condition deteriorates, consistent with the directives of the *Collège des médecins du Québec* [CMQ, 2020].

Sources: Collège des médecins du Québec, 2020; Wong et al., 2019 (CCS); INESSS, 2016a.

N

15. The physician in charge of the patient at the non-PCI hospital has the following responsibilities during the episode of care:

- assess the patient's initial condition and monitor their progress;
- determine the indication for and modality of reperfusion – and clearly document the reason for choosing not to reperfuse, if applicable, in the patient's medical chart;
- initiate the interhospital transfer process at the appropriate time, if necessary;
- specify the level of care to be provided during this transfer;
- ensure the level of competence of the personnel assigned to the transfer, taking into account the patient's clinical condition and destination. Accompanying personnel must be trained and competent in defibrillation, cardioversion, cardiostimulation and recognition of arrythmia.

If there is any doubt about the safety of an interhospital transfer, the physician consults the receiving doctor or a doctor who has experience with transferring critically ill patients to adjust the transfer arrangements.

Note: Protocols for transfer to PCI hospitals are also addressed by standard #32 in the network section of this document. They include a requirement that the non-PCI hospital inform the PCI hospital that a transfer will take place.

Source: Collège des médecins du Québec, 2020.

N

16. For urgent interhospital transfer requiring medical escort (that is, in addition to ambulance personnel), the non-PCI hospital that is part of a STEMI network ensures the availability of appropriate resources (e.g., respiratory therapist, nurse) within a maximum of 30 minutes after patient triage.

Source: Collège des médecins du Québec, 2020.

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[7] Based on the experience of members of the *Comité national d'experts du continuum de services en IAMEST,* it is important to use a protocol to optimize transfer time when there is a need for medical escort due to an anticipated transport time of more than 60 minutes.

[8] The document by the *Collège des médecins du Québec* [CMQ, 2020] specifies the clinical criteria for medical escort (chapter 6).

N

17. If an interhospital transfer to a PCI hospital is being considered, the consent of the patient (or their authorized proxy) is obtained by the non-PCI hospital, taking into account the benefits and risks associated with the transfer, and information relevant to this consent (or an inability to obtain it) is documented in the patient's medical chart.

Source: Collège des médecins du Québec, 2020.

N

18. If a physician is not accompanying the patient during transfer to a PCI hospital, the non-PCI hospital ensures that any accompanying personnel will be able to communicate at all times with the physician in charge of the patient at the hospital of origin.

Source: Collège des médecins du Québec, 2020.

N

19. Patients presenting to a non-PCI hospital who are awaiting interhospital transfer for primary or rescue PCI remain in an observation area that allows for clinical surveillance, including cardiac monitoring.

Source: Ibanez et al., 2018 (ESC) [class I; level of evidence C].

NM

20. When transferring for PPCI, the delay from triage to departure from the emergency department of the non-PCI hospital is a maximum of 30 minutes.

TARGET: The delay between triage and departure from the emergency department at a non-PCI hospital is a maximum of 30 minutes for at least 75% of patients transferred for PPCI.

Sources: Wong et al., 2019 (CCS) [for the standard: strong; level of evidence low]; Beygui et al., 2020 (ACCA-ESC); O'Connor et al., 2015 (AHA); O'Gara et al., 2013 (AHA); CCN, 2013a; Wilson et al., 2013.

R

21. A patient in cardiogenic shock is transferred with medical escort as rapidly as possible to initiate PPCI within a maximum of 120 minutes from first medical contact, at a PCI hospital with the required range of hemodynamic support. Ideally, this centre offers extracorporeal membrane oxygenation and ventricular assistance.

If such a centre is not available in a timely manner, the patient is transferred to the closest PCI hospital to initiate PPCI within a maximum of 120 minutes from first medical contact.

If PPCI is not available within a maximum of 120 minutes from first medical contact, immediate fibrinolysis followed by urgent transfer to a PCI hospital that offers extracorporeal membrane oxygenation and ventricular assistance is considered, based on an assessment of the risks and benefits of fibrinolytic therapy.

Sources: Wong et al., 2019 (CCS) [weak; level of evidence very low]; Ibanez et al., 2018 (ESC) [for PCI: class I, level of evidence B; for fibrinolysis: class IIa, level of evidence C]; Pilarczyk et al., 2020 (GGWGMSS) [strong, level of evidence 1+]; Beygui et al., 2020 (ACCA-ESC); Zeymer et al., 2020 (ACCA-ESC); Van Diepen et al., 2017; O'Gara et al., 2013 (AHA) [class I, level of evidence B].

NM

22. When no reperfusion treatment is delivered by the non-PCI hospital to a patient with suspected or confirmed STEMI, the reason(s) justifying this choice is (are) documented in the patient's medical chart.

Sources: CCN, 2013a; Lambert et al., 2016; Masoudi et al., 2008 (AHA).

2.5 Hospitals that offer percutaneous coronary intervention (PCI) (PCI hospitals)

The following standards apply to hospitals that perform PCI. These centres provide specialized care to patients who arrive directly (by ambulance or by other means) as well as to patients that have been transferred from a non-PCI hospital with or without having received fibrinolysis therapy. Patients treated by PCI after interhospital transfer usually return to their hospital of origin for the remainder of their care.

NM

23. The catheterization laboratory is activated by a single call from a designated person.

Sources: Wong et al., 2019 (CCS) [strong; level of evidence moderate]; NICOR, 2019; O'Gara et al., 2013 (AHA); Jollis et al., 2012a.

R

24. a) The PCI hospital has at least one care provider (p. ex. nurse, radiology technician) on site or close by who is able to prepare the catheterization laboratory within 30 minutes of the call to activate the room.

b) The clinical team responsible for PCI is ready to receive the patient in the catheterization laboratory within a maximum of 30 minutes following the call to activate the room.

Sources: Wong et al., 2019 (CCS); Ibanez et al., 2018 (ESC); Collège des médecins du Québec, 2020; O'Gara et al., 2013 (AHA); CCN, 2013a; Jollis et al., 2012b.

N

25. Each STEMI network provides priority, rapid, 24/7 access to an intensive care unit or coronary care unit with expertise in advanced cardiac care. In this regard, all PCI hospitals have such a unit, with the resources and equipment necessary to provide care consistent with their mission, including treatment for acute ischemia, severe heart failure, malignant arrhythmia and common comorbidities.

Source: Ibanez et al., 2018 (ESC) [class I; level of evidence C].

NM

26. Patients transported to a PCI hospital following transmission of prehospital ECG results by telemetry or following evaluation at a non-PCI hospital arrive directly at the catheterization laboratory (rather than at the emergency department) when the room and the clinical team responsible for PPCI are ready to receive them.

Note: In special circumstances, the patient's condition might be stabilized in the emergency department first (e.g. intubation required, convulsions, severe impairment of alertness).

Sources: Wong et al., 2019 (CCS) [weak; level of evidence very low]; Ibanez et al., 2018; O'Gara et al., 2013 (AHA); O'Connor et al., 2015 (AHA); Fosbol et al., 2013; Bagai et al., 2013a, b; Anderson et al., 2015; Hagiwara et al., 2014.

NM

27. If an ECG is deemed necessary at a PCI hospital, it is acquired, and the results interpreted by a physician, within a maximum of 10 minutes after triage of the patient.

TARGET: The first in-hospital ECG is acquired at a PCI hospital within a maximum of 10 minutes after triage for at least 75% of patients for whom it is clinically indicated.

Note: Rapidity is important here; evaluation in the real-world care context carried out by INESSS [2016a] showed that, for patients who already had a prehospital ECG that was positive for STEMI, the acquisition of another ECG in hospital was associated with an increased delay before reperfusion treatment.

Sources: Wong et al., 2019 (CCS) [for the standard: strong; level of evidence low]; INESSS, 2016a; CCN, 2013a; Mission: Lifeline, 2014 et 2013; AETMIS, 2008, citing AHA's practice guidelines by Antman et al., 2004 [class I, level of evidence C].

N

28. The delay between arrival of the patient in the catheterization laboratory and the first intervention with intention to treat with PPCI is a maximum of 30 minutes.

TARGET: The first intervention with intention to treat with PPCI is carried out at a PCI hospital within a maximum of 30 minutes after patient arrival in the catheterization laboratory for at least 75% of patients.

Source: Wong et al., 2019 (CCS).

R

29. For patients admitted directly to a PCI hospital, the delay between first medical contact and the first intervention with intention to treat with PPCI is a maximum of 90 minutes, but can be extended to a maximum of 120 minutes in the situation of a patient being transported from a remote region (requiring more than 30 minutes of transport).

TARGET: The first intervention with intention to treat with PPCI is carried out at a PCI hospital within a maximum of 90 minutes after first medical contact for at least 75% of directly admitted patients.

Note: The maximum of 120 minutes reflects the real-world context of rural regions with longer transport times. It is also consistent with the maximum of 120 minutes that applies to patients who need interhospital transfer to access PPCI.

Sources: Wong et al., 2019 (CCS); Beygui et al., 2020 (ACCA-ESC); for the standard: O'Connor et al., 2015 (AHA) [class I, level of evidence A]; O'Gara et al., 2013 (AHA); Quraishi et al., 2016 (CCS); CCN, 2013a; for the target: Quraishi et al., 2016 (CCS); Mission: Lifeline, 2014.

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30. The PCI hospital documents that a PCI has been carried out in the *Banque ministérielle de maintenance et exploitation des données pour l'étude de la clientèle hospitalière* (MED-ÉCHO).

Note: A recent analysis by INESSS [2020] observed that 25% of all PCI performed were not documented in MED-ÉCHO by the treating centres (a similar observation was made in 2012). There is a specific code for PPCI in the regulatory framework of the MED-ÉCHO system.

Source: expert committee.

NM

31. When no reperfusion treatment is delivered by the PCI hospital to a patient with suspected or confirmed STEMI, the reason(s) justifying this choice is (are) documented in the patient's medical chart.

Sources: CCN, 2013a; Lambert et al., 2016; Brown et al., 2014; Masoudi et al., 2008 (AHA).

2.6 Networks: communication, structure and integration of services

R

32. a) STEMI networks are officially designated and are composed of a single PCI hospital, one or more referring non-PCI hospitals and emergency medical services that can provide initial transport to these centres or interhospital transfer[9].

Each STEMI network ensures that protocols regarding optimal reperfusion strategies and processes of care are in place and implemented. Such protocols encourage appropriate activation of the catheterization laboratory during the prehospital phase, single call activation of interhospital patient transfer and bypassing of non-PCI hospitals by ambulances when direct transport for PPCI is possible. Prehospital services direct patients according to explicit protocols that designate destination hospitals.

b) Each non-PCI hospital in a network is in partnership with the PCI hospital on a no-refusal basis for interhospital transfers, and according to a formal agreement. This written agreement specifies that the non-PCI hospital is responsible for selecting patients who will benefit from the exclusive services of the PCI centre, and for informing the PCI hospital that an interhospital transfer will take place. However, this agreement does not eliminate the need for the sharing of relevant information between hospitals (e.g., the patient's clinical profile). A second, "back-up" PCI hospital is designated for interhospital transfer in exceptional circumstances, on a no-refusal basis.

Sources: Wong et al., 2019 (CCS) [strong; level of evidence moderate]; Ibanez et al., 2018 (ESC) [class I; level of evidence B]; Beygui et al., 2020 (ACCA-ESC); Collège des médecins du Québec, 2020; AHA, 2018; Green et al., 2018; Jollis et al., 2018; O'Gara et al., 2013 (AHA); CCN, 2013a and 2013b; Mission: Lifeline, 2013; Rokos et al., 2013 (Mission: Lifeline); Jollis et al., 2012a.

N

33. The default reperfusion strategy of each non-PCI hospital is officially designated as (1) interhospital transfer for PPCI or (2) fibrinolysis, taking the relevant standards of this document into account.

TARGET 1: In order for a non-PCI hospital to use interhospital transfer for PPCI as the default reperfusion strategy, the first intervention with intention to treat with PPCI is carried out at the PCI hospital within a maximum delay of 120 minutes after first medical contact at the non-PCI hospital for at least 75% of its transferred patients.

Note: The evaluation in the real-world care context carried out by INESSS in 2016 indicated that the 120-minute maximum target for interhospital transfers is unlikely to be met if the average duration of transport between the two hospitals is greater than 45 minutes [INESSS, 2016a].

[9] Based on the experience of members of the *Comité national d'experts du continuum de services en IAMEST,* services are ideally grouped in the territory of the *Centre intégré universitaire de santé et de services sociaux* of the PCI centre.

TARGET 2: In order to use fibrinolysis as the default reperfusion strategy, the non-PCI hospital starts fibrinolytic therapy within a maximum delay of 30 minutes after first medical contact at the non-PCI hospital for at least 75% of its patients treated by fibrinolysis. The same target applies to PCI hospitals for their patients treated by fibrinolysis [INESSS, 2016c].

Sources: Wong et al., 2019 (CCS); Beygui et al., 2020 (ACCA-ESC); Mission: Lifeline, 2014; O'Connor et al., 2015 (AHA) [class I, level of evidence A]; O'Gara et al., 2013 (AHA) [class I, level of evidence B]; CCN, 2013a.

N

34. Each STEMI network applies protocols for transfers to a PCI hospital after fibrinolysis treatment by a non-PCI hospital. These protocols consider the clinical context and level of risk associated with the patient (e.g., persistent ST elevation or previous MI), geographic distance and available resources.

Sources: Wong et al., 2019 (CCS); Bainey et al., 2019.

R

35. For patients referred for PPCI or following fibrinolysis treatment, the PCI hospital ensures that a detailed report of any angiography or other procedures performed and the plan of care is provided to the team at the non-PCI hospital upon the patient's return.

Note: If the patient is returned home, this information is transmitted to the treating physicians – e.g., cardiologist or internist and family physician, if applicable.

Sources: CCN, 2013a; Mission: Lifeline, 2013; Rokos et al., 2013 (Mission: Lifeline).

N

36. Interhospital transfer arrangements to local non-PCI hospitals following patient management by a PCI hospital are agreed upon, systematized and integrated into each regional STEMI network.

Note: The objective here is not only to reduce interhospital transfer delays, but also to facilitate management of beds and to maximize the quality of the patient experience. The arrangement must comply with applicable ministerial memoranda.

Source: Collège des médecins du Québec, 2020.

2.7 Support of quality improvement

NM

37. A PCI hospital maintains a minimum volume of 400 PCI and 50 PPCI per year. Interventional cardiologists at each PCI hospital maintain a minimum volume of 100 PCI and 25 PPCI per year. These volumes are calculated using an average over three years.

Sources: Quraishi et al., 2016 (CCS); CCN, 2013a.

R

38. Each component of each network (that is, PCI hospital, non-PCI hospital, emergency medical services) designates a person responsible for quality improvement who monitors the performance of care and services for patients with STEMI on a monthly basis.

Sources: Granger et al., 2019; Jollis et al., 2018; Jollis et al., 2012b; Masoudi et al., 2008 (AHA).

R

39. Each component of each network (that is, PCI hospital, non-PCI hospital, emergency medical services) has a formal and dedicated continuous quality improvement committee, whose members meet every 3 months to address management of STEMI. Minutes of these meetings are produced.

Sources: Granger et al., 2019; Jollis et al., 2018; CCN, 2013a.

R

40. Each regional STEMI network evaluates all aspects of its performance, including treatment delays, rates of reperfusion and rates of unnecessary activations of the catheterization laboratory. At the minimum, measurement of priority quality indicators is documented for a reasonable sample[10] of cases.

For each PCI hospital, as well as for all its referring hospitals and emergency medical services:

Processes of care and delays are presented and discussed at least once annually at multidisciplinary meetings that focus on collaboration and performance improvement to develop action plans, if deemed relevant. Participants include medical and administrative managers from each hospital, as well as all hospital and prehospital care teams concerned. The content of the meetings is documented.

Sources: Wong et al., 2019 (CCS) [strong; level of evidence low]; Ibanez et al., 2018 (ESC); NICOR, 2019; Scholz et al., 2020; Candiello et al., 2020; Granger et al., 2019; Jollis et al., 2018; O'Gara et al., 2013 (AHA); CCN, 2013a; Mission: Lifeline, 2013; Rokos et al., 2013 (Mission: Lifeline); Jollis et al., 2012b; Masoudi et al., 2008 (AHA).

[10] The objective is to have reliable measures to support decision-making.

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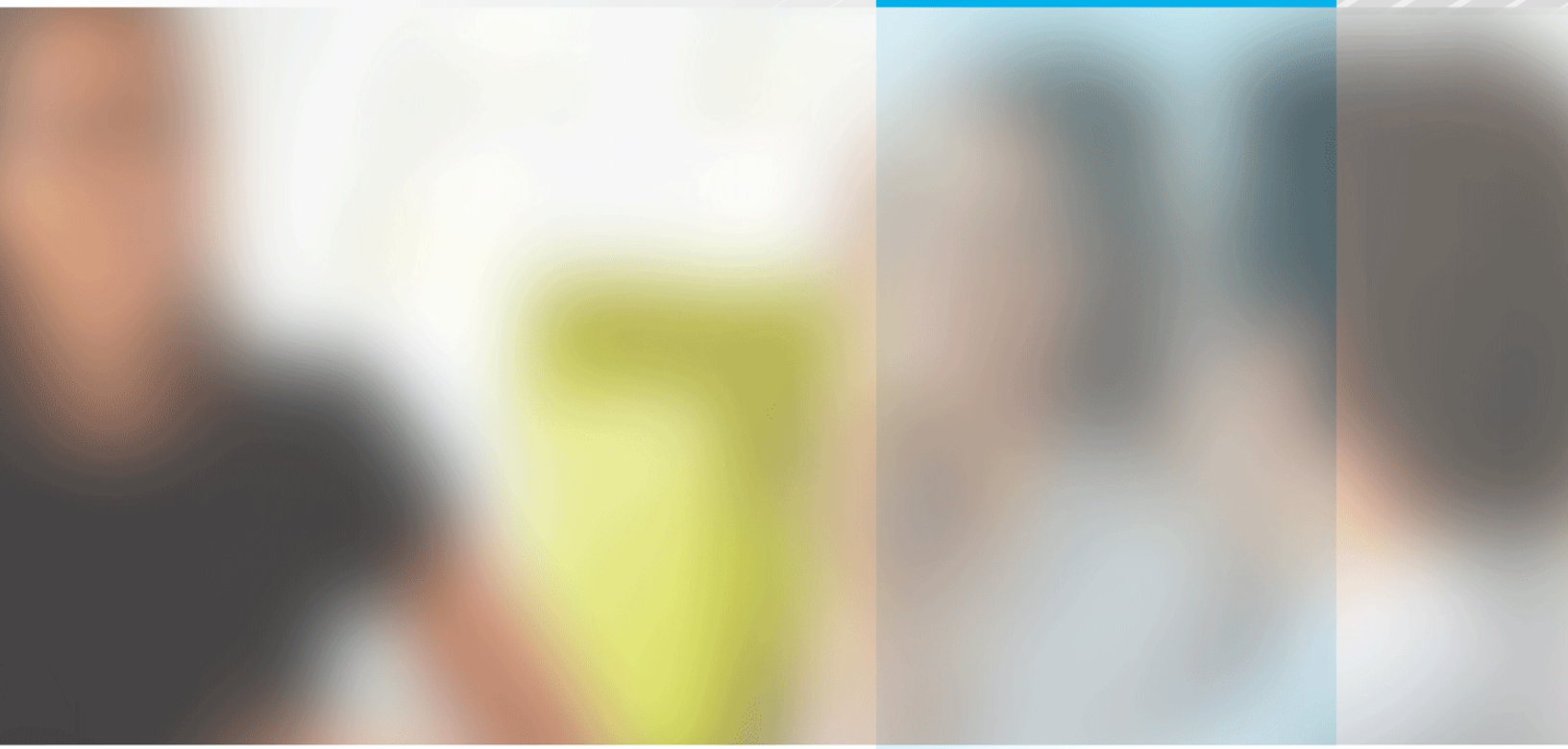

Siège social

2535, boulevard Laurier, 5e étage
Québec (Québec) G1V 4M3
418 643-1339

Bureau de Montréal

2021, avenue Union, 12e étage, bureau 1200
Montréal (Québec) H3A 2S9
514 873-2563
inesss.qc.ca

Institut national d'excellence en santé et en services sociaux
Québec